

Urban Integrated Field Laboratories

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Informing environmental justice and science underpinning equitable climate and energy solutions

Understanding the predictability of urban systems and interactions with the climate system and providing the knowledge and information necessary to inform equitable climate and energy solutions that can strengthen community-scale resilience across urban landscapes is a crucial challenge. Urban systems are comprised of interdependent environment, ecological, infrastructure, and human components.

To address this challenge, the Earth and Environmental System Sciences Division (EESDD) within the Department of Energy's (DOE) Office of Biological and Environmental Research (BER) is supporting the development of Urban Integrated Field Laboratories (UIFLs). UIFLs emphasize the basic sciences of climate, environmental, ecological, and urban change affecting heterogeneous urban regions, with a view toward informing sustainable, resilient, and equitable solutions.

UIFLs must involve diverse scientific disciplines to develop comprehensive projects, including field observations, data assimilation, modeling, and model-data fusion, to inform equitable solutions based on state-of-the-art uncertainty quantification and data analytics. Research combines new observations with high-resolution and highly detailed urban modeling, where data generated by observations and models are used for scientific analysis.

UIFL research teams are comprised of diverse institutions, including DOE national laboratories, academic and nonprofit research institutions, other federal agencies, and private sector organizations. These laboratories provide opportunities to inspire, train, and support leading scientists from a variety of organizations, including minority-serving institutions (MSIs), who have an appreciation for the global climate and energy challenges of the 21st century.

They tap the imagination and creativity of a diverse scientific and stakeholder community to address the fundamental questions of how

urban systems work under the pressures of a dynamically changing climate and this new knowledge can be harnessed for some of our most critical real-world challenges.

Because EESDD's UIFL activity is intended to inform environmental justice and associated science underpinning equitable solutions, local organizations and MSIs have significant roles in each UIFL management team. UIFLs engage a diverse workforce to include the many communities, identities, races, ethnicities, backgrounds, abilities, cultures, and beliefs of the American people, including underserved communities.

Four UIFLs were announced in fall 2022. These projects were selected by competitive peer review under the DOE Funding Opportunity Announcement DE-FOA-0002581: Urban Integrated Field Laboratories. Each UIFL represents different aspects of understanding urban systems, including diverse demographic characteristics, differing climate-induced pressures on people and infrastructures, and unique geographic and climatic settings.

Baltimore Social-Environmental Collaborative Urban Integrated Field Laboratory (BSEC UIFL)

The Baltimore Social-Environmental Collaborative (BSEC) seeks a new paradigm for urban climate research. BSEC focuses on Baltimore, a metropolitan area that is representative of the climate challenges faced by many mid-sized industrial cities in the United States, and in particular with eastern "rust belt" cities that face interlinked challenges of aging infrastructure, stagnant populations, increased heat and flood risk, and inequitable burdens of air and water pollution.

BSEC begins with community priorities (human health and safety, affordable energy, transportation equity, and others) and city government priorities (clean waterways, decarbonization, functioning

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Baltimore Social-Environmental Collaborative Urban Integrated Field Laboratory (BSEC UIFL)

21cc.jhu.edu/research/baltimore-social-environmental-collaborative-ifl/

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Community Research on Climate and Urban Science Urban Integrated Field Laboratory (CROCUS UIFL)

www.anl.gov/evs/community-research-on-climate-and-urban-science-crocus

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Southwest Urban Corridor Integrated Field Laboratory (SW-IFL)

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Baltimore Social-Environmental Collaborative (BSEC) and Community Research on Climate and Urban Science (CROCUS). *The BSEC Urban Integrated Field Laboratory in Baltimore, left, focuses on climate challenges that many mid-sized industrial cities must address. Focused on the Chicago region, right, CROCUS employs observational and modeling capabilities to address ways to mitigate climate change that will be useful to other major U.S. cities.*

infrastructure) and designs observation networks and models that will deliver the climate science capable of supporting those priorities.

Community Research on Climate and Urban Science Urban Integrated Field Laboratory (CROCUS UIFL)

The Community Research on Climate and Urban Science (CROCUS) UIFL is a community-driven scientific effort to understand the interactions between cities and climate. The large CROCUS team, led by Argonne National Laboratory and including an inclusive set of scientific, educational, and community organizations, will advance urban science in the highly diverse Chicago region as a playbook that can be used by other major cities.

The Chicago region, reclaimed from a swamp and nestled between the understudied, but critically important, Lake Michigan and former prairie land now converted to agriculture, presents formidable opportunities for novel science. CROCUS will enable just, long-term societal benefits from climate mitigation and adaptation, such as reducing emissions and adapting neighborhoods to address future effects of climate change.

Southeast Texas Urban Integrated Field Laboratory (SETx UIFL)

The Gulf Coast contains an extensive and diverse range of natural features and human settlements, with a disproportionate number of vulnerable communities. The region faces regular “acute-on-chronic” hazards in which short-notice technological and natural stressors (e.g., coastal storms, oil spills) occur alongside long-term chronic

environmental, industrial, and social stressors (e.g., subsidence, population growth, toxic pollution). The proposed region for the UIFL is Southeast Texas (SETx), specifically the Beaumont-Port Arthur region.

This urban area represents the climate adaptation needs, population diversity and vulnerability, and ecological richness that characterize many urban centers along the Gulf Coast. The long-term goals for SETx-IFL are to provide quantitative understanding of projected climate change impacts across SETx-IFL in a way that is generalizable to other regions and improve the practice of resilience science and community resilience through new and generalizable theories of change validated in SETx-IFL.

Southwest Urban Corridor Integrated Field Laboratory (SW-IFL)

The Southwest Urban Corridor Integrated Field Laboratory project (SW-IFL) led by Arizona State University (ASU) will study the rapidly urbanizing “megaregion” that stretches across the state of Arizona from the Mexican border in the south to the Navajo (Diné) Nation in the north. This growing urban megaregion is experiencing stresses resulting from a warming climate and population growth.

With most of the region’s urban areas routinely experiencing 30+ days of temperatures above 110°F each summer, the population is stressed by the complex interactions of extreme heat, atmospheric pollutants, and limited water. The SW-IFL will seek to provide scientists and decision makers with high-quality, relevant knowledge capable of guiding responses to these environmental concerns.



Southeast Texas (SETx) and Southwest Urban Corridor (SW-IFL). *The Gulf Coast region, left, has its own unique challenges and needs including acute-on-chronic hazards, along with long-term environmental, industrial, and social stressors, all of which SETx-IFL is working to address. The Southwest Urban Corridor IFL represents one of the fastest-growing urban corridors in the United States, including Tucson; Phoenix, right; and Flagstaff, Arizona.*